National Park Service
U.S. Department of the Interior

Glacier National Park

Winter Ecology

1st-2nd Grade Field Trip

Preparing For Your Trip

Welcome and Need to Know Information

Dear Teacher,

This packet contains all the information you will need to prepare your students for a winter field trip to Glacier National Park.

- The field trip lesson plan on pages 15-20 should answer most questions about field trip logistics, objectives, and schedules.
- The rest of the lessons are meant to prepare students for the concepts and vocabulary highlighted on the field trip. Each activity can serve as a pre-visit introduction or a post-visit assessment/extension. A suggested unit plan organization is located on the following page.
- Glacier's SmartBoard lessons are a great way to supplement this unit. Students will learn about the importance of Glacier's snowpack, how to dress for winter, and lots more!
- Visit our **website** for more lesson plan ideas and background information for any field trip. This guide contains only a sample of what is available.

Be sure to confirm the date(s) and meeting place for your field trip (received via email is/are correct). There is no cost for this field trip. A waiver for the park entrance fee has been processed for your class(es). Travel grants may be available to schools with restricted travel budgets.

The education ranger assigned to your group will call you before your field trip date to discuss the schedule and answer any questions. You can also reach them at 406-888-7899.

Our winter education programs are made possible by the support of the Glacier National Park Conservancy. Thank you for introducing your students to the National Park Service Mission and the wonders of Glacier!

Glacier National Park
Education Staff

Glacier National Park
CONSERVANCY

Glacier National Park's Education Goals

- Provide opportunities for the students to form emotional and intellectual connections with park resources and values.
- Introduce students to the National Park Service mission and the significance of Glacier National Park.
- Provide curriculum-based, outdoor education experiences that are age appropriate and supplement classroom learning objectives.
- Introduce students to the value of protecting natural and cultural resources for current and future generations and to encourage actions we can all take to be good stewards of this special place.

	Summary	Objectives *Students will be able to:*	MT and Next Generation Science Standards	Materials
Pre-Field Trip *Dressing for Winter*	A model demonstrates dressing in 3 layers and describes the purpose behind each layer and type of material.	• Wear appropriate clothing for winter activities. • Describet the 3 clothing layers to wear for outdoor winter activities and why each layer is needed. • Relate that similar to plants and animals, people must also prepare for winter.	MT.SCI.K-12.1.4...Follow appropriate safety rules.	• Warm clothing (base layer/long underwear, fleece, coat, snow pants, shirt/pants, socks, etc.) • Student templates on pages 7-8
Pre-Field Trip *The Story of Snow*	Students listen to ***The Story of Snow*** and participate in a large-group discussion about the events and elements that form snowflakes.	• List the three essential components of a snowflake (air, water, particle). • Describe the events that form snowflakes.	MT.SCI.K-12.3.4...Recognize that all types of precipitation are different forms of water and identify characteristics of different...weather conditions 2-ESS2-3...Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form.	• "The Story of Snow" by M. Cassino and J. Nelson.
Pre-Field Trip *Spring, Summer, Fall, WINTER*	Students discuss the characteristics of each of the four seasons by comparing photographs of Montana during spring, summer, fall, and winter.	• Describe Montana's four seasons-spring, summer, fall, winter. • Use visual/picture cues to identify seasons.	MT.SCI.K-12.1.2...Describe local climate conditions for each season.	• Photos of Montana in summer, fall, winter, and spring
Field Trip *Winter Ecology in Glacier*	Students examine the winter environment and its effects on plants, animals, and people by going on a snowshoe hike.	Display a variety of knowledge and skills related to winter ecology and Glacier National Park.	Vary depending on field trip. Talk to the ranger before your visit for more information.	• Warm clothes • Name tag • Lunch • Adult helpers
Post-Field Trip *Write Your Ranger*	Students recall information and activities from their field trip to write a letter to their park ranger.	• Write a letter to their ranger.	ELA/Literacy W.2.8 Recall information from experiences or gather information from provided sources to answer a question.	• Writing/ drawing materials • Paper • Envelopes

Lesson 1: Pre-Visit

Dressing for Winter

Materials:
* Warm clothing (ex: base layer/long underwear, fleece, coat, snow pants, shirt/pants, socks, etc.)
* Student templates on pages 7-8.

Vocabulary

Insulation.

Method

A model (either the teacher or a volunteer) demonstrates dressing in 3 layers and describes the purpose behind each layer and type of material.

Objectives

- Students will be able to choose appropriate clothing for winter activities.
- Students will explain what the 3 clothing layers should be for outdoor winter activities and why each layer is needed.

MT State Science Standard

MT.SCI.K-12.1.4 Students, through the inquiry process, demonstrate the ability to design, conduct, evaluate, and communicate results and reasonable conclusions of scientific investigations.
- A proficient student will follow appropriate safety rules.

Next Generation Science Standard

1-LS1-1. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.
- Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world. (1-LS1-1)

Background

Just like the animals in Glacier, people must prepare their bodies to be outside in the winter. Some animals prepare by adding a layer of insulating fat to their bodies. Others grow a thick winter coat to trap their body heat close to their skin to keep them warm. Since people can't easily insulate our bodies with seasonal fat or fur, we must use clothing to keep us warm and safe. The first rule of dressing for winter is layering. Layering clothing keeps moisture away from skin, creates insulation to keep the body warm, and protects against the "elements" - wind, snow, rain.

Outer layers should repel water and stop the wind to protect the wearer from convection heat loss and allow ventilation to minimize evaporative heat loss.

Background continued

Middle layers should insulate the body. They should also "breathe" easily. Inner layers of clothing should be of materials that "wick" moisture away from the skin. Finally, all layers of clothing should dry rapidly, preferably from body heat alone (i.e. cotton is not a great choice for winter clothing. It absorbs water into its fibers and stays wet for a long time).

Gloves and mittens protect hands from being cold while a pair of wool socks or polypropylene will keep feet warm even if they get wet.

Procedure

1. Discuss with students some ways wild animals stay warm in winter. For example, most mammals (bears, white-tailed deer, beavers, etc...) use fat to stay warm. Their fur also grows thicker and/or longer to insulate the animal's body.
2. Show students the winter-dressed student on an interactive whiteboard or document camera. Because people can't use seasonal fat or grow a fur coat, people rely on clothing to stay warm. Discuss the things everyone should remember to bring to be safe and warm while snowshoeing in Glacier (hat, coat, mittens, etc.).
3. Explain to students that you will show them how to dress for outdoor winter activities. Knowing how to dress for winter weather is the first step to having a great time outdoors and being safe.
4. Select a student to be the model. Over their regular clothes, prepare the model for a day snowshoeing in Glacier.
    - Start with base layers, like long underwear. Discuss how the special material of these kinds of clothing helps to keep the body warm and takes moisture away from the body.
    - Add middle layers. These could include athletic pants, a wool sweater, a fleece layer etc.
    - Put on the outer layer. Discuss how winter coats and snow pants are made of special material to keep the body dry, even when it's raining or snowing.
    - Don't forget gloves or mittens, hats, and boots.
5. Mention that dressing in layers allows you to add or subtract layers of clothing depending on the weather and temperatures.
6. Another option is to bring in a backpack or bag with the clothing in it and have different students come up and pull out an article and decide if they are appropriate - make sure to include cotton jeans, a baseball cap, a goofy T-shirt, & perhaps some other article that students will chuckle about).

Evaluation

Have students draw themselves all ready for a field trip snowshoeing in Glacier, making sure they are bringing all of the necessary items. Use the template on page 8. Older students can list and describe each clothing layer and its function.

Extension

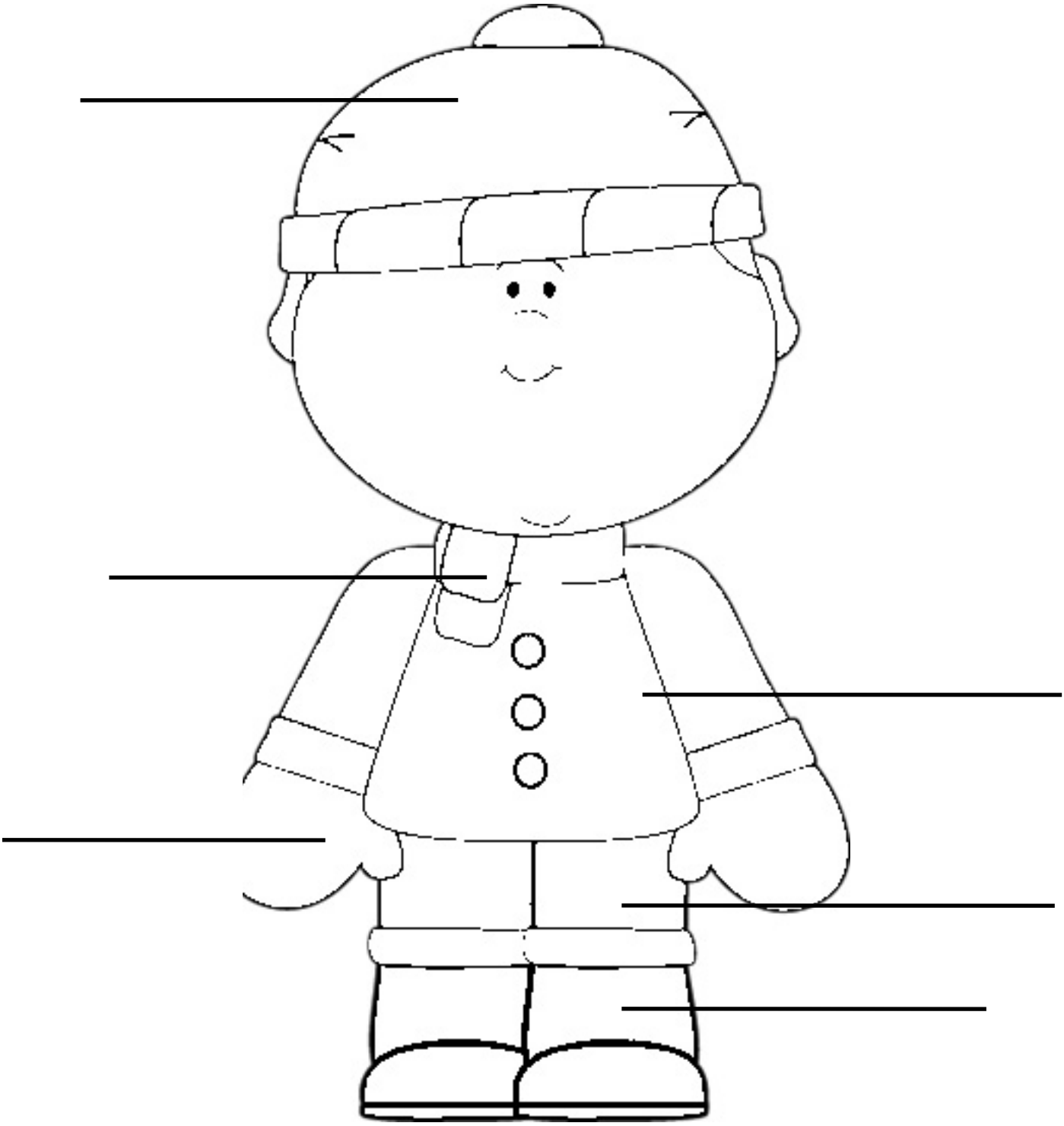
Have students think about how animals "get dressed" for winter.

Can students think of other things, besides clothes, that could keep them warm outside in the winter? (Drink hot chocolate, build a fire, exercise, etc.)

For review on the 3 layers, have students visit the Winter Feels Good website and Dress the Snowmonsters.

Name: _____ Dressing for Winter

This student is ready for a winter field trip in Glacier! Fill in the blanks to help you remember the right clothes to wear to be warm and safe outside in the winter.

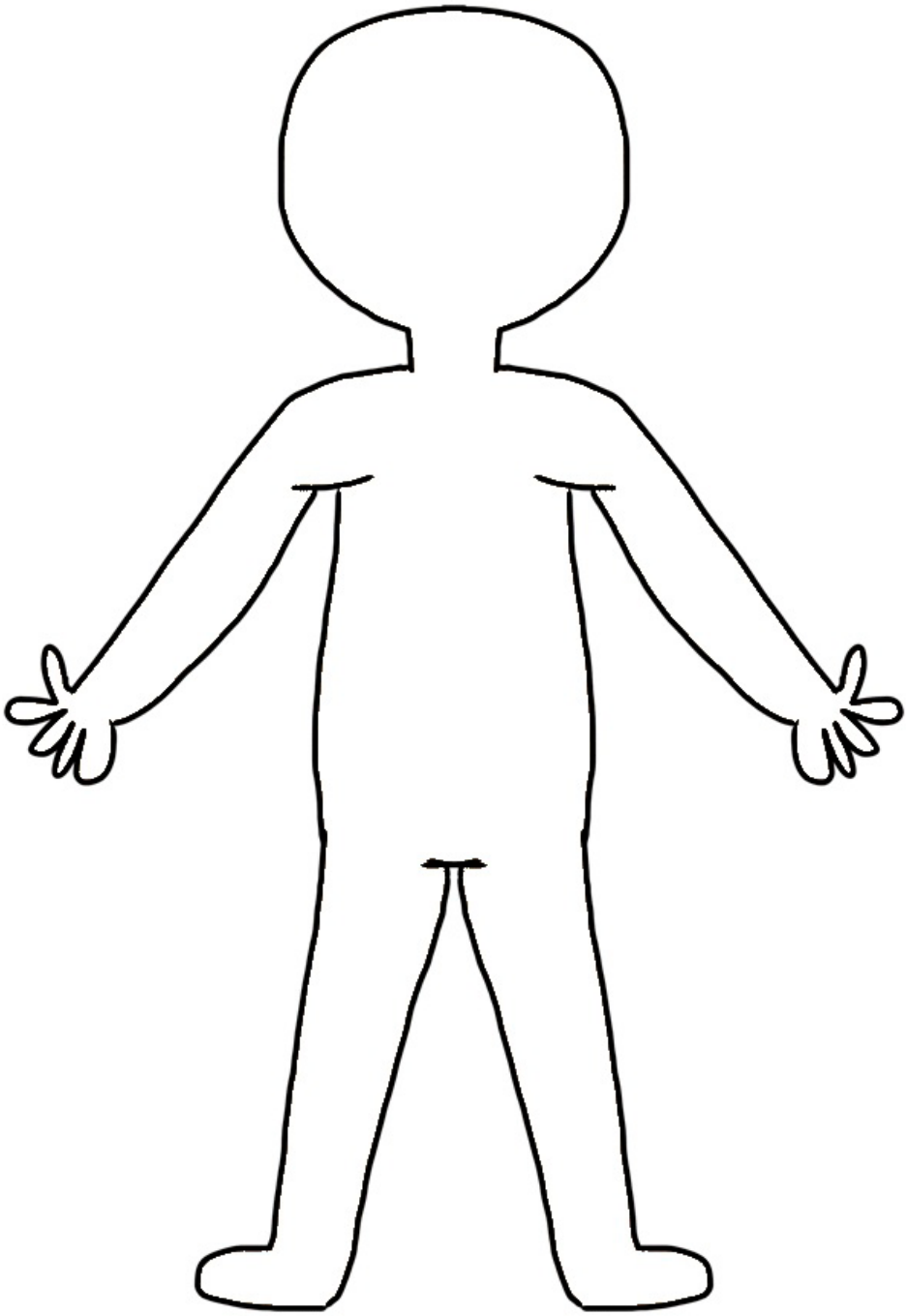


Dressing for a Winter Field Trip to Glacier

How should you dress to go snowshoeing in Glacier National Park? Don't forget these:

socks long-sleeve shirt long pants snow boots snow pants

winter coat gloves or mittens warm hat yummy lunch



When your teacher says you have Gabby ready, take your drawing home to remind YOU and your family what you need for your Glacier field trip.

Lesson 2: Pre-Visit

The Story of Snow

Materials:

* "The Story of Snow" by M. Cassino and J. Nelson (also available on Tumblebooks, if your school subscribes)

Vocabulary

Snowflake, crystal, water vapor, precipitation.

Method

Students will listen to "The Story of Snow" and participate in a large-group discussion about the events and elements that form snowflakes.

Objectives

Students will be able to:

- List the three essential components of a snowflake (air, water, dust).
- Describe the events that form snowflakes.

MT State Science Standard

MT.SCI.K-12.3.4 Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of Earth's systems and other objects in space.

- A proficient student will recognize that all types of precipitation are different forms of water and identify characteristics of different types of weather conditions.

Next Generation Science Standard

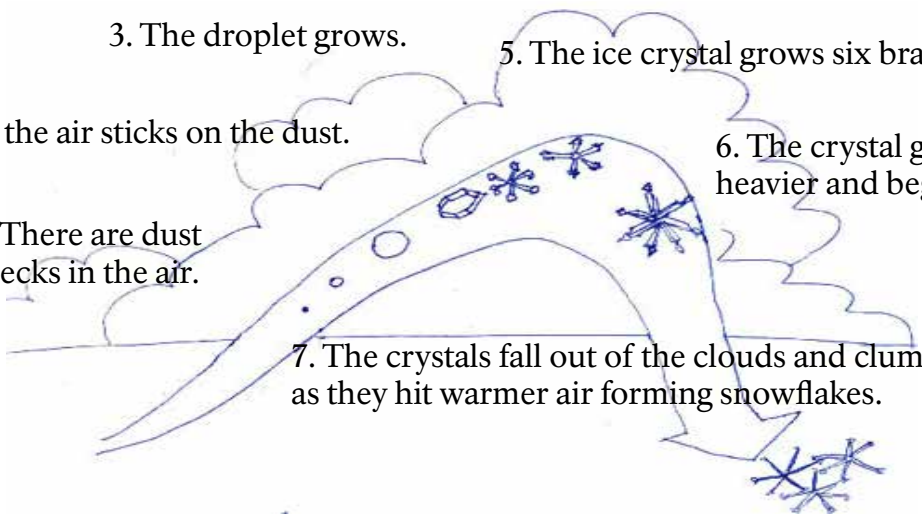
2-ESS2-3. Obtain information to identify where water is found on Earth and that it can be solid or liquid.

- Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form. (2-ESS2-3)

Background

A snowflake forms when an extremely cold water droplet freezes onto a speck (pollen, dust, bacteria, etc...) in the sky. This creates an ice crystal. As the ice crystal falls to the ground, water vapor freezes onto the crystal, building new crystals – the six arms of the snowflake.

Background Continued



Procedure

1. Read "The Story of Snow" by Mark Cassino and Jon Nelson to the whole group. This book is also available on Tumblebooks, if your school subscribes.
2. The main text of the book explains just the basics of what makes up snowflakes and how snowflakes form.
3. Additional information throughout the book provides more details about the process.

Evaluation

1. Students can correctly name the three components of a snowflake.
2. Draw or cut- out a snowflake that has the correct number of sides (six).
3. Draw or describe the events that form a snowflake.

Lesson 3: Pre-Visit

Spring, Summer, Fall, Winter

Materials:
* Photos of Montana in summer, fall, winter, and spring

Vocabulary

Seasons, summer, fall (autumn), winter, spring, daylight.

Method

Students discuss the characteristics of each of the four seasons by comparing photographs of Montana during spring, summer, fall, and winter.

Objectives

Students will be able to:

- List Montana's four seasons-spring, summer, fall, winter.
- Use visual/picture cues to identify seasons.

MT State Science Standard

MT.SCI.K-12.1.2 Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of Earth's systems and other objects in space.

- A proficient student will describe local climate conditions for each season.

Next Generation Science Standard

1-ESS1-2. Make observations at different times of year to relate the amount of daylight to the time of year.

- Patterns in the natural world can be observed, used to describe phenomena, and used as evidence. (1-ESS1-1),(1-ESS1-2)

Background

Every season in Montana holds surprises. Rainfall is generally light, with most falling in spring between May and July. Average rainfall for western Montana is 18 inches a year; 13 inches for the east.

During summer, brief mid-day thunderstorms are a common, and the heavy rains cool the late afternoon temperatures. By the time fall rolls around, the weather becomes cooler. In October, beautiful fall colors burst to life across the state. Frost often covers the ground before the sun gets high enough to chase it away. Winters in Montana, while usually cold, have few extended cold spells. Montana's cold spells are sometimes interrupted by warm, dry chinook winds that cause mild periods that last for ten days or more. An-

Background, Continued

nual snowfall in western Montana can reach up to 300 inches (25 feet) in the Rocky Mountains; the east may get as little as 20 inches. Heaviest snowfall occurs between November and March, but snowstorms can occur as early as mid-September or as late as early May in the higher Southwestern part of the state. In the spring and early summer months, when the snow in the mountains begins to melt, Montana's river's swell with run-off. Heavy rains falling during the spring thaw constitute a serious flood threat. Ice jams in the rivers during the spring can also cause flooding.

Procedure

1. Gather images from Montana, or Glacier National Park, in each season. This can be done online with a search for "Glacier National Park winter" or "Montana winter." Continue collecting images for spring, summer, and fall.
2. Introduce the names of the seasons to students. Discuss what they know about each season with questions like: What happens to plants? What are animals doing? What do you like to do outside in this season?
3. Bring images of different seasons up on an interactive whiteboard, one at a time. Discuss each picture. Have students decide what time of the year the picture shows. Ask students to give specific reasons to support their answers.
4. Explain that, just like each of the other seasons, winter is a special time of the year in Montana. It is usually a time of colder temperatures, snowy weather, and shorter days and longer nights. These are some of the things that make winter different than the other seasons.

Evaluation

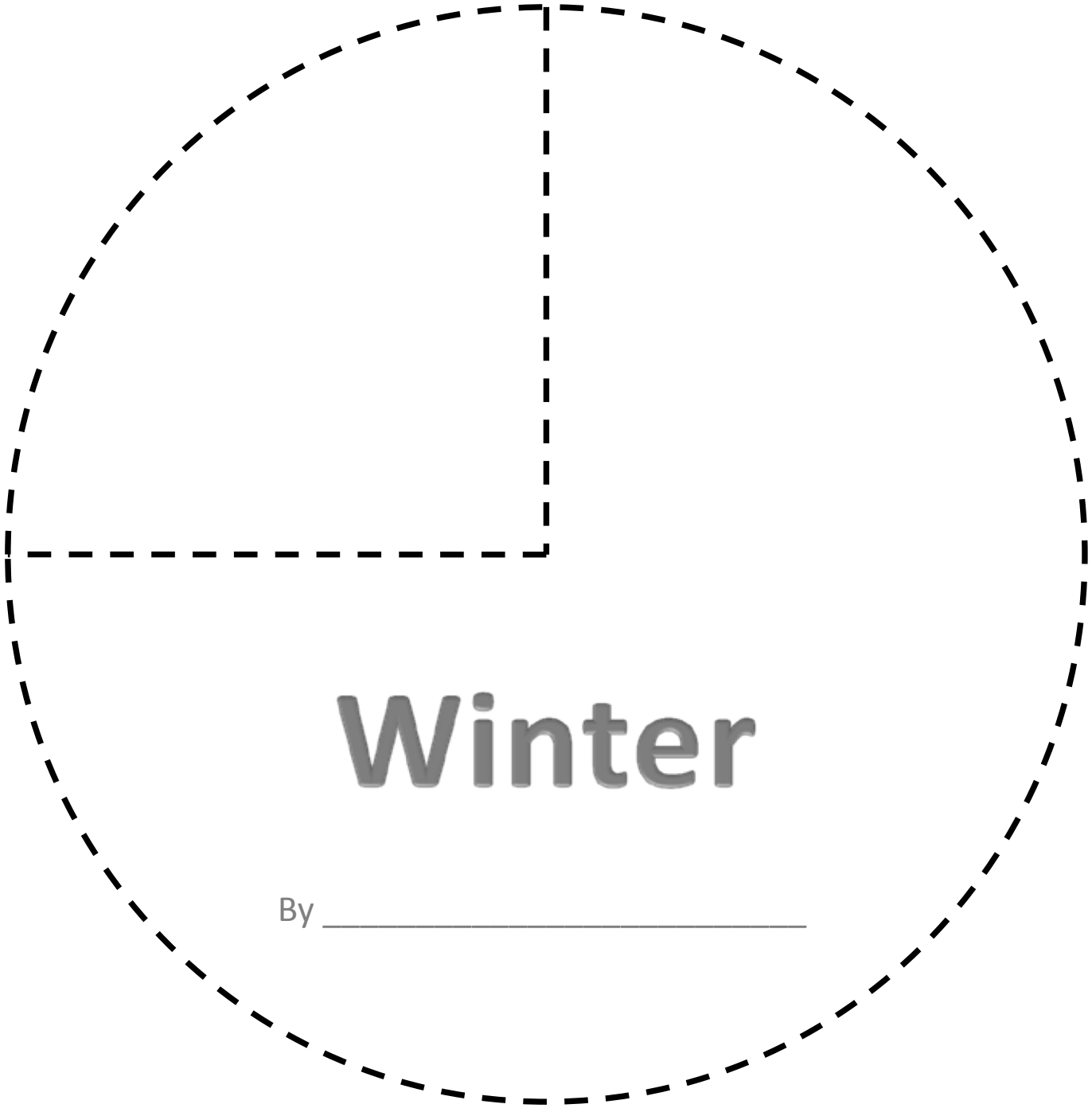
Ask students to describe characteristics of each season and to tell which season different pictures show, supporting their answers with information gathered from the photo.

Extension

Listen to and sing this Seasons Song to remember how each season is different (or make up your own seasons song to a familiar tune).

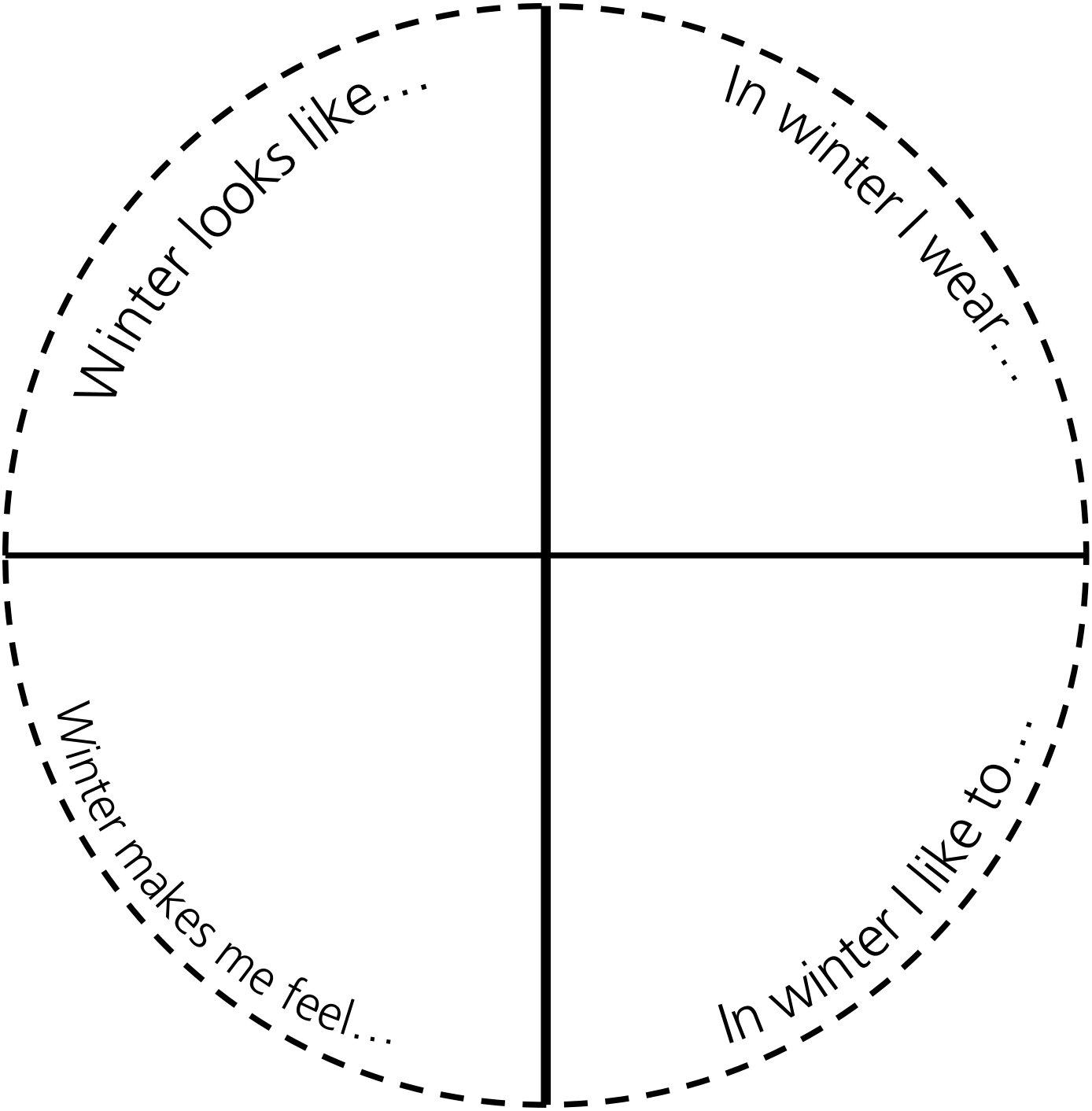
Here we go, oh, oh
Seasons of the year
Here comes the spring with the rain pouring down
Here comes the spring with the flowers in the ground
Here comes the spring with the rainbow in the sky
Here comes the spring to bring new life
Here comes the summer with the heat from the sun
Here comes the summer with the kids having fun
Here comes the summer with the warm breeze
Here comes the summer with the trees so green
Here comes the fall with the leaves changing color
Here comes the fall with the weather getting cooler
Here comes the fall with the leaves falling down
Here comes the fall with the wind blowing loud
Here comes the winter with the ice and the snow
Here comes the winter with the freezing cold
Here comes the winter with the days getting shorter
Here comes the winter with the nights getting longer

Have students complete the Winter Wheel on the following pages. Students can write words or draw pictures to complete each sentence about winter.



Winter

By _____


Winter looks like…
In winter I wear…
Winter makes me feel…
In winter I like to…

Lesson 4: Field Trip

Winter Ecology in Glacier

Remember:

Flexibility is essential for an enjoyable visit to Glacier. Each program is unique but the following represents a typical visit.

Vocabulary

Varies by field trip but may include: national parks, preserve, protect, sun, earth, heat, energy, seasons, winter, snow water equivalent, water cycle, weather, climate, temperature, adaptation, migration, hibernation, resistance, food chain, subnivean, predator, prey, camouflage, insulation, snowpack, habitats

Method

Students will conduct a simple snow experiment, view a puppet show of how animals in Glacier survive winter, and take a short snowshoe hike to a beaver lodge with stops to investigate animal signs & snow characteristics.

Objectives

Students will be able to (depending on grade level and weather condition):

- Recognize the National Park Service symbol and list things national parks preserve and protect.
- Describe the relationships between sun, heat, light, energy, and food; how they change during the year; and why it's hard for animals to survive winter.
- Create a food chain with animals that stay active in Glacier in the winter.
- Classify pictures of Glacier animals into groups according to which strategy (adaptation) they use to survive winter: migration, hibernation, or resistance.
- Conduct an experiment, including: making a prediction, comparing/contrasting changes in snow, communicating observations and results.
- Describe one way that water changing from a liquid to solid (or solid to liquid) could help a wild animal, and a way it could hurt a wild animal.
- Dress appropriately to hike on snowshoes, following safety procedures.
- Recognize signs of animal activity, tracks along the trail, shelters, etc.
- Use their body to show evergreens' adaptations for dealing with snow.
- Describe one way a tree or a plant might change in winter.
- Use their body to increase heat (run, huddle, put on insulation, etc.).
- Explain how changing color (camouflage) could help animals avoid predators as their habitat changes through the seasons.
- Measure, compare, and explain the varying snow depths at different points along the trail. Discuss how snow can help or hurt animals.

Objectives, Continued

- Compare walking in snow with and without snowshoes and decide which uses less energy. Compare people in snowshoes to animal adaptations.
- Create a food chain or web with organisms that stay active in Glacier during winter, including animals that use the subnivean environment.
- Compare weather/climate, heat/temperature, and wind chill.
- Describe one way a plant might change in winter.
- Measure, compare, and infer why the snow depth varies along the trail. Discuss how snow depths can help or hurt different animals in winter.
- Relate the basic needs animals must have in order to survive in their habitats to reasons why there are threatened and endangered species in the world.

MT State Science Standards

MT.SCI.K-12.1 Students, through the inquiry process, demonstrate the ability to design, conduct, evaluate, and communicate results and reasonable conclusions of scientific investigations.

MT.SCI.K-12.3 Students, through the inquiry process, demonstrate knowledge of characteristics, structures, functions of living things...and how living organisms interact with each other and their environment.

Next Generation Science Standards

2-ESS2-3.Obtain information to identify where water is found on Earth and that it can be solid or liquid.

K-ESS3-1.Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.

While these standards are the most applicable for what we highlight during an education program, there are many other standards that may also apply.

Background

Glacier National Park protects habitat for plants and animals and preserves natural processes. Glacier provides an undisturbed location to study the interrelationships of living things with their environment during winter.

Sample Field Trip Schedule

8:30 a.m. – 9:30 a.m. Travel to the Park
Simple assignments can be completed during this time. Point out sights along the way that relate to the park story such as the amount of snow along the route, if they see farm fields or ranches versus cities or forests.

9:30 a.m. – 10:00 a.m. Meet Park Rangers at Designated Site.
After a welcome by park rangers to Glacier National Park, the group will talk about the National Park Mission and take a snack/bathroom break.

10:00 a.m. – 11:00 a.m. Snow Experiment and Puppet Show
Rangers will discuss national parks introduce the snow experiment. Students will make predictions about how much water and how much air is in the snow. Students will view a puppet show about how animals survive winter in Glacier.

11:00 a.m. - 11:30 a.m. Wrap-Up Snow Experiment and Eat Lunch

11:30 a.m. – 1:15 p.m. Snowshoe Hike

1:15 p.m. – 1:30 p.m. Snowshoes Off and Bathroom Breaks

1:30 p.m. – 1:45 p.m. Bus Leaves the Park

Protecting the National Park

In order to have a fun and exciting experience, a firm framework of rules should be discussed in advance. The discussion should include the following points:

- Respect both plants and animals in Glacier National Park.
- Harassing animals and picking flowers, pine cones, feathers, and other natural objects in the park are illegal.
- Respecting rights of others in Glacier by refraining from disruptive behavior.
- Respecting each other, the ranger, chaperones, and teachers (walk on trails, keep hands to yourself, wait to talk until the instructor is finished, etc...)

School Regulations and Safety

Teachers are responsible for following school regulations regarding parental permission slips, travel authorization/insurance, etc. An accident can ruin a field trip and jeopardize future ones. Safety is of utmost importance. Students must be with adults at all times.

Clothing

Remind students to check the weather and bring appropriate, comfortable clothing, including a hat, snow pants, winter coat, gloves/mittens, and boots. Encourage students to bring extra layers and dry clothes.

Name tags

For safety and courtesy, rangers prefer to call students by name. Masking tape with names written in big letters, works well. If you make name tags as a pre-visit activity, be sure they are easy to read and stay on when the students are active.

Food and Lunches

Everyone needs a lunch and drink. Re-sealable drinks work best as they can be refilled and saved. No food or drink is available at the park. Students are expected to clean up the lunch area. Food/gum are prohibited except at designated times.

Groups

See the chaperone guidelines on the next page. Typically it works best to assign adults to groups of students before arriving at the park. (A typical bus of 45 students would be divided into nine groups of 5 students each.)

Items to Leave Behind

Students should not bring iPods, CD players, radios, cell phones, or money. These items can be lost and may be a distraction. Adults should also leave cell phones at home (or turned off) during the field trip. Cameras and binoculars will not be needed and may only be brought if they will be used at ranger approved times. Designating one adult as the class photographer and asking them to take pictures throughout the day to share with everyone is a great alternative.

Winter Weather and Road Conditions

Check road conditions and weather conditions the morning of your field trip. Webcams will show you the weather in Glacier in real time. Call the Education Staff (406-888-7899) with questions. Programs may be cancelled if the day's high temperature, with wind chill, is to be 10°F or below. Sometimes modified programs are an option. Talk with your rangers to find out more.

Chaperone Guidelines and Responsibilities

The chaperone requirements for ranger-led educational field trips to Glacier are (these numbers include the teacher):

- Kindergarten - 2nd Grade = 1 adult for every 3 students (example: 22 students, 8 adults required/allowed).
- 3rd - 5th grade = 1 adult for every 5 students (example: 22 students, 5 adults required/allowed)).
- 6th grade and higher = 1 adult for every 10 students (example: 22 students, 3 adults required/allowed).

Please assist your child's teacher by volunteering to help with a field trip to Glacier, or by respecting their apologies when your help is not needed because it exceeds the park's guidelines listed above. Our facilities, staffing, and resource protection mandate that we limit not only the number of students we can handle per trip, but also the number of adults with each group.

If you are selected to help with a field trip, know that you are an important partner in our program. We need your participation and cooperation to make the trip a success and will be asking this of you:

- **Do not bring siblings who are not part of the class.** Your full attention is needed to help monitor the students assigned to you that day.
- **Please ride on the school bus.** It makes getting everyone through the entrance station much easier and avoids parking problems.
- **Assist with safety.** It will be one of your primary duties as a chaperone.
- **Be an active participant.** Students will want to participate if you do.
- Provide guidance to students for lunch and clean-up.
- Help set boundaries and provide leadership.
- Guide the learning process and help focus students on the activity or speaker.
- **Please consult with your school administrators about the policy regarding firearms on school sponsored events.** We have never had an injury from a wildlife encounter in over 20 years of conducting school field trips in Glacier. Rangers carry bear spray, first aid kits, and radios and will show the group how to hike and recreate safely while in the park.
- Most importantly go with the flow, adapt, and have fun in Glacier! The students pick up on how you react if you are having fun, they will too!

Sample Evaluation of Ranger

United States Department of the Interior

NATIONAL PARK SERVICE
Glacier National Park
West Glacier, Montana 59936

IN REPLY REFER TO:

Dear Teacher:

Thank you for participating in the education program at Glacier National Park. We hope that the field trip provided your class with an opportunity to better understand the significance of their national park. To help us better prepare for your next visit, please take a few minutes to complete this evaluation of our program. We greatly appreciate your thoughts and comments.

Date of Field Trip:_____

Please let us know how your field trip went with a short comment for each of the items below.

Name of Ranger(s):_____	# Rating
Rangers' behavior and responsiveness to students, teachers, and chaperones was appropriate.	
The ranger-led program was presented in a clear and appealing manner at an appropriate level for the students.	
The rangers showed concern for the safety of the participants.	
Rangers were adequately prepared.	
Program registration and pre-program information/contact was sufficient.	

Additional comments about the program, ranger(s), or pre-visit information:

Sample Evaluation of Ranger

United States Department of the Interior

NATIONAL PARK SERVICE
Glacier National Park
West Glacier, Montana 59936

IN REPLY REFER TO:

Dear_____:

Thank you for participating in the education program at Glacier National Park on _____.

We hope that the field trip provided your class with an opportunity to better understand the significance of their national park. As a follow-up we are sending all participating teachers this evaluation to help you better prepare for your next trip. This evaluation is intended to point out strengths as well as areas that need additional attention.

Students wore name tags and were properly dressed for the day.	
Snacks/lunches were organized for easy distribution and everyone assisted with lunch clean-up.	
There were an appropriate number of chaperones present.	
Chaperone(s) actively participated in supervising students.	
Pre-site class preparation was evident.	
Class behavior facilitated a positive learning environment.	

Additional comments:

Sincerely,

Park Ranger(s)

Lesson 4: Post-Visit

Write Your Ranger!

Materials:

* Paper and pencils for letter-writing
* Other art supplies: crayons, colored pencils, construction paper, etc.

Vocabulary

Letter, dear, sincerely, date, signature.

Method

Students write a letter to their park ranger to share what they learned on their field trip in Glacier National Park.

Objectives

Students will be able to put into words what they learned on their Glacier field trip.

- Recall information they learned on their field trip and include it in a letter to their ranger.
- Write a formal letter to the park rangers.

Common Core Standard

ELA/Literacy W.2.8 Recall information from experiences or gather information from provided sources to answer a question.

Background

This activity gives teachers a chance to expand the science learning at the park to language arts lessons. They will be able to help dictate the length and depth of the letters and gauge the appropriate writing level. Rangers enjoy reading about what the students learned. The education staff at the park see many school groups during the year but rarely get to find out what the students really learned or remember later. Letters from students always brighten the day! Some of the letters are even posted in the Education Center.

Procedure

1. Review with students the field trip. Perhaps showing photos from the day. Make a list together of the activities they remember.
2. Have information displayed and a sample "Dear Ranger," letter template.
3. Work with students to tell the rangers their favorite thing, what they learned, or what more they would like to know.
4. Have them sign their letters with just their first names.

Evaluation

Teachers decide on rubric for the letters to include factual information, spelling, grammar and sentence structure.

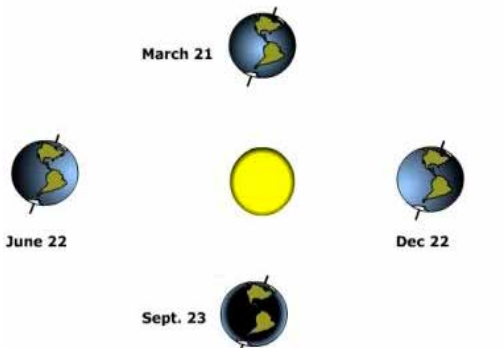
Extension

Students draw a picture to accompany the letter.

Teacher Resources

Additional Background Information

What is Winter?
Winter is the season of the longest night, the shortest day, the least light, as well as the presence of snow, cold and wind chill. It is the slowest growing season for plant life. Food supplies dwindle and it is a hard time for animals. Winter poses many challenges to plants and animals. Winter Ecologist, James Halfpenny, refers to these challenges as the SCREW factors: snow, cold, radiation, energy, and wind. In northern **latitudes** winter is the longest and most difficult season of the year. **Temperature**, snow depth, snow density as well as the duration of winter (a deep snow pack and late season snow extend the winter season) determine the severity of winter and play a role in how many animals survive. Many animals will die during winter. **Winterkill** refers to the combined effects of bad weather, malnutrition, starvation, disease and predation. Winter is a time for economy: food is scarce and energy must be conserved. It is truly a time of survival of the fittest.



Winter solstice (December 21) is the shortest day of the year and the day winter "officially" begins. Interestingly enough, the earth is actually closer to the sun in winter (see diagram) not further away.

What Causes Winter?
As the earth travels around the sun, different regions receive more direct sunlight than others. The tilt of the earth on its **axis** is responsible for the different **seasons** in the northern and southern **hemispheres**. In the summer, when the North Pole is tilted toward the sun, the northern hemisphere gets more direct sunlight and the days are longer than during spring, fall and winter. In winter, the tilt is away from the sun and sunlight strikes the northern hemisphere at a lower angle. Latitude is what determines both the length of the day and the angle of the sun (Waterton/Glacier International Peace Park is pretty far north and straddles the 49th parallel along the Canadian border). The amount of sunlight striking the earth's surface (**solar insolation**) and the length of the day are determined by the position of the sun in the sky. The reduced amount of winter sunlight striking the earth due to shorter days and angle of the sun causes colder temperatures. As the land and its air mass cools, surface waters turn to ice and **precipitation** freezes to cover the land with snow.

At northern latitudes and in mountainous terrain, winter comes early and stays late. At higher **elevations** the **atmosphere** is thinner and holds less warmth. Consequently, it's colder, snow lasts longer, and the length of the growing season is greatly reduced. Elevations in Glacier range from less than 3,200 feet in the Lake McDonald valley to 6,646 at Logan Pass, to more than 10,000 feet on the tallest mountains in the park. In Glacier National Park, the seasons are jokingly referred to as "June, July, August and winter." There is some truth to this as the high country may be snow-free for only about 3 months of the year. It is not unusual to see visitors skiing at Logan Pass in June and occasionally even into July. Winter lasts a long time throughout most of the park.

It is worth noting that since the **Continental Divide** runs through the middle of Glacier National Park, the weather on the west and east sides of the park are different. The west side is

greatly influenced by Pacific Northwest weather patterns. These weather systems provide more rain, milder temperatures and (generally) moister snow than the east side receives. The east side of the park is influenced by continental weather systems characterized by less precipitation and strong, gusty winds. During winter, cold fronts moving down from Siberia and Alaska through Alberta along the **Front Range** can flow over the passes and settle in western valleys. Sub-zero temperatures can last for days or weeks. Eventually, a warm moist Pacific air mass will move in. As it moves over the mountains, the moisture condenses and precipitation occurs. The process of **condensation** releases heat that was stored in the moisture-laden air (thus the east side of the mountains is warmer than the west side at the same elevation). As this warm air moves down the east slope, it picks up speed and creates winds that can exceed 80 mph. These warm winds are known as a **"Chinooks,"** an Indian word for "snow eater." Chinooks can cause temperatures to rise from below zero to above freezing within hours.

Snow

Snow has many different "personalities" depending upon how much water, ice, and air it contains. Snow with high water content can easily be formed into snowballs. Powder snow is so fluffy and dry that it's nearly impossible to pack. Temperatures and wind can affect what happens to snow after it falls. It can be a light fluffy layer or it can harden into an icy surface. Snow crystals not only change as they fall through the air, but they continue to change within the snow pack over time, in a process know as **age-hardening.**

Let's consider the water content of snow first as this is an important resource for people. Rangers in Glacier National Park have been doing Snow Surveys to measure the amount of water in the snow pack for over 80 years. Snow surveys in the West date back to the early 1900s and the Department of Agriculture's cooperative snow survey program for predictions of meltwater runoff. This program is a federal, state, and local partnership directed by the Natural Resources Conservation Service or NRCS (http://www.nrcs.usda.gov/feature/highlights/SnoServ.html). To find out how much water will be available in summer, snow surveyors from NRCS and the other cooperating agencies collect data from some 1,600 snow courses several times each winter. They determine the depth and the water content of the snowpack and estimate the amount of runoff from the mountain watersheds. The information collected by the snow surveyors (and the automated telemetry system) is translated into water supply forecasts that NRCS State offices issue monthly from January to June in cooperation with the National Weather Service. Major sectors of the Western economy- agriculture, industry, and recreation- base their plans on these forecasts. Since Triple Divide Peak in Glacier National Park divides water flowing to the Columbia River Drainage (1), Hudson Bay Drainage (2), and Missouri River Drainage (3), the amount of snow that falls here (and its cleanliness) is crucial for people living in those three watersheds.

Now let's consider how temperature affects snow and thus animals. Fallen snow is not always the same temperature. When the bottom layers of snow are much warmer than the top layers, water vapor creates a bottom or in-between layer that is granular and resembles sugar. This type of snow allows small animals like mice, voles and shrews to readily tunnel through it. Because it contains a lot of air it also is good insulating snow for grouse to hunker down in on a cold night. Animals that paw through snow like moose, deer and elk can easily uncover grasses.

But air temperatures and wind can also alter snow crystals over time to form a hard, compacted snow mass with an even temperature throughout. This type of snow is difficult for mice to burrow through. (Yet, this same snow allows snowshoe hares and deer to reach up higher in shrubs and trees in search of food.) Compacted snow such as this can cause a build-up of carbon dioxide in the lower layers as a result of decaying vegetation. Many of the small "mouse holes" seen on the surface are actually vent holes that allow carbon dioxide to escape. Without them, mice and other **subnivean** (under the snow) dwellers could die.

Why does temperature affect snow this way? Melting and refreezing changes the physical characteristics of the snow. It causes snow crystals to reshape and form a very solid layer. The strength of the snow varies, depending upon whether it is in the melt or freeze stage. Some animals can travel on the surface, while others not as well adapted, will fall through and flounder, becoming easy prey for **predators**. An icy crust allows small animals to move with ease, but may cut a deer's legs, allowing bacteria and infection to spread in an animal already in a weakened condition.

What about the depth of the snow? How does that affect wildlife? When snow gets deep, deer will **yard up** (stay in one location) since bounding through snow requires a lot of energy. Deer have such small feet in relationship to their size, they sink through snow. By yarding, they pack down a network of trails that permits them to reach areas containing winter food. At the same time, there are risks associated with it. During long, hard winters, there is the risk of **overbrowsing** their winter range. And there is an increased risk of spreading diseases when many animals are confined to a relatively small area. Moose and elk can "plow" through deep snow. Moose are especially well adapted for it with their long legs. However, moose will frequently follow already established trails, while elk tend to follow in trails made by a strong lead animal. These modes of travel are known as **trailing**, and they are a means of reducing energy output. Many other animals take advantage of already established trails. Even snowshoe hares establish trails or "bunny runs" as they travel to and from their feeding areas. By using trails, winter animals can help minimize their energy output.

The depth, density and hardness of the snow can help or hinder animals depending upon the situation. A build up of snow on branches of trees may break and snap or bend young trees. Heavy snow on trees can restrict tree travel for pine martens and squirrels, making it more difficult to catch prey or to escape predators. Willows and alders bent by the weight of heavy snow provide food and shelter for snowshoe hares. Where the branches of spruce and fir catch falling snow, the snow depth becomes unequal on the forest floor. In open areas snow is deeper than beneath trees. Trees with full crowns collect most of the snow on branches. The small amount that reaches the ground quickly melts or evaporates leaving a "snow shadow" or **tree well**. Many small animals avoid tree wells during the coldest part of winter since they offer little insulation or protection but if the branches are heavy enough with snow and press close enough to the ground, wind breaks are formed and tree wells become cozy hideouts for animals like snowshoe hares. As winter merges into spring, tree wells are the first places that juncos and other returning birds search for food.

How Do Organisms (living things) in Glacier Survive Winter?
Adaptations: Migration, Hibernation, Resistance (Toleration)
Organisms, or living things, all have adaptations - structures or behaviors that help them to survive in their environment. Winter ecologists classify organisms according to how they experience winter and how they have adapted to it over time. The commonly used system based on the Greek work "chion" for snow has three levels: **chionophobes=** "snow fearers" have been unable to adjust to life in the snow and are usually found in warmer regions (black vultures, palm trees); **chioneuphores=**"snow tolerators" have adjusted their life to winter and can survive but have no special adaptations (shrew, red vox, vole); **chionophiles=** "snow lovers" possess definite adaptations for life in winter and whose geographic distribution is generally limited to winter-dominated regions (spruce tree, mountain goat, snowshoe hare, ptarmigan, and weasels).

An even more basic classification system for how animals cope with winter is based on their main adaptation strategy for winter survival: **migration**, **hibernation**, or **resistance**/toleration (Marchand, 1996). Basically, living things either leave to find an area that is more suitable for them in winter (migrators) or they stay and are not active (hibernators, or organisms that have periods of torpor), or they stay and are active (resistors/tolerators). The following is generalized information about how different groups of organisms deal with winter.

Plants in Winter
By the end of summer or early autumn many plants have died back. **Annuals** will have produced seeds that have fallen to the ground and will germinate next year while the "mother" plant dies. Other seeds, housed inside plump, juicy berries will be eaten by birds, bears or other animals. Since the seeds are not digested, they will be "planted" in new locations within the droppings of these animals. The stems and leaves of **biennials** will die their first winter, but their roots will remain alive while the second year plants produce seeds to ensure survival. **Perennials** die back to the ground each year, but their roots live through winter and the plant will grow back each spring.

The leaves of **deciduous** trees and shrubs change color as daylight hours wane. Soon the leaves will be shed. Lowered temperatures will retard plant growth. **Leaf scars** are sealed with a corky layer and next year's **buds** are covered with scales to conserve moisture. Winter is similar to drought as water is unavailable when it is frozen as ice or snow. Woody shrubs and trees survive the winter in a state of **dormancy**. Evergreen trees and shrubs have thin or small needle-like leaves with waxy coatings to conserve moisture.

The conical shape of many **evergreen** trees makes them more resilient to heavy snow loads. Since their branches slope out and downward, the weight of snow pressing down allows snow to fall off. If enough snow falls from the branches it can pull the branches until they touch the ground and make a wall of snow and branches around the base of the tree. These tree wells can become shelter for wildlife out of the wind. Evergreen trees will photosynthesize at the first available light in spring.

Insects in Winter

Just as many plants go through a resting phase in winter, many insects time their particular life cycle stage best suited to withstand cold, drought-like conditions and lack of food. During this time, activities and/or development discontinue until conditions become favorable in spring. Individual species of insects overwinter at different stages of their metamorphosis.

Douglas Fir Beetle Larvae in Gallery

Insects comprise the base of the food chain and the absence or presence of their populations has a large effect on food availability for other organisms. Chickadees feed largely on insects and have the ability to hang upside down on branches to look for insects hiding on the undersides of leaves and branches. It is interesting to think about what happens to insects, an important food source in winter.

Insects that have incomplete metamorphosis (egg, nymph and adult) usually overwinter in the egg stage. For insects that develop through complete metamorphosis (egg, larva, pupa and adult), the egg and pupa are the most likely stages for overwintering since they are immobile and they have a protective coating that helps them withstand the cold. But some insects like the woolly bear caterpillar overwinter as a larva. The woolly bear stops eating in late summer and finds a sheltered place under leaves and grass. In spring, it forms a cocoon and emerges as an Isabella moth.

Woolly Bear Caterpillar (larval stage)

Insects that overwinter as adults usually find a sheltered place: under leaves, in crevices in trees, under bark, rocks, plants, in buildings, or they descend into the ground and remain dormant. Staggered timing of life cycles ensures that food will be available when they reach the eating stage. Insects react to cold temperatures by slow, stiff movements and a lowered metabolic rate. They lose a high percentage of water and produce glycol, a substance that acts as a kind of antifreeze. We think of these organisms as hibernating to avoid winter, but they actually have complex strategies to resist severe cold stress. On warm days adult insects move around as their bodies warm up sufficiently. The table on the next page lists some of the common insects and their overwintering strategies.

How and Where Some Insects Over-Winter

Insect	Species	Overwintering Stage	Special Preparation	Active or Inactive	Where?
Ants	Carpenter	Adult	Produce glycerol	Inactive	In trees or logs
Aphids	Most	Egg	None	Inactive	In bark crevices or base of twigs
Bumblebees		Queen	Pre-fertilized eggs inside queen	Inactive	Underground, under leaves or logs
Butterflies	Monarch	Adult	Migrate	Semi-active	Mexico or CA
Butterflies	Painted Lady	Adult	Lose body moisture	Inactive	Under bark
Butterflies	Swallowtails	Pupa	Form chrysalis	Inactive	Attached to stems or on the ground
Crickets	Most	Egg		Inactive	In the ground
Dragonflies	Some	Egg		Inactive	On the bottom of a pond
Dragonflies	Some	Nymph		Semi-active	On the bottom of a pond
Flies	Cluster & House flies	Adult		Inactive except when warm	In crevices of buildings or cracks in hollow trees
Grasshoppers	Most	Egg		Inactive	In the ground
Beetles		Larva (grubs)		Inactive	In the ground
Honeybees		Adult	Store food	Semi-active	Hive in a tree or man-made box
Ladybug	All	Adult	Cluster together	Inactive	Under leaves and grasses

Galls

Galls form when insects lay their eggs on plants. A swollen lump on the stem or leaf of a plant may be a gall. Galls can be a variety of sizes, shapes, and colors, some up to the size of a baseball! Most galls form on plant leaves but they can also form on branches, twigs, buds, flowers, fruits, and even roots. Some insects lay their eggs on the plant surface and others make a hole in the plant and insert their eggs inside. Not everything is known about gall formation but in response to the egg-laying, the plant either produces new cells or enlarges existing cells around the area. The newly formed gall provides some protection to the insect eggs (and larvae when they hatch) from the sun, wind, rain, and predators, but not fool proof. There are other insects that invade galls looking for food. Winter is a good time to look for galls since there are fewer leaves on plants.

Animals in Winter
Hibernation
Animals that spend the winter in Glacier National Park are either active or dormant. Dormancy ranges from short periods (**torpor**) to long periods **(hibernation**). Skunks and badgers, for instance may undergo periods of torpor as an energy saving measure during times of extremely cold weather. Hibernators generally sleep through the winter although they may awaken and move around. Hibernation can be defined as a physical state where an animal's body functions slow down in order to conserve energy through a season of no food and water, and cold temperatures. The extent to which the metabolism slows in order to be considered a "true hibernator" is debatable. Hibernators such as Columbian ground squirrels and marmots have drastically reduced body temperatures. A ground squirrel's temperature may drop to 39 degrees Fahrenheit compared to its usual 90 degrees Fahrenheit temperature. Reduced temperatures slow other processes so pulse and respiration rates drop. Breathing may be once every 4 to 6 minutes. At this slow pace, a minimum of energy is expanded and the animal's fat layers can usually meet their slight demand. Many hibernators also curl up into a ball to conserve heat. Ground squirrels and marmots therefore, are considered "true hibernators."

Whether animals, like bears and chipmunks, hibernate or not depends on your source and definitions. Living things do not follow definitive rules. Thus, there is a continuum between the "true hibernation" of ground squirrels and marmots in which all bodily functions are greatly slowed, the deep sleep of bears and chipmunks, and the occasional sleep of raccoons and gray squirrels. Hibernation is the extreme end of the continuum. Bears are said to not truly hibernate because although their bodily processes are slowed, they do not have the reduced body temperatures of other "true hibernators." But bears develop thick coats of fur and have less surface to mass ratios than smaller hibernators so they stay warmer. Bears' metabolism drops by half and their digestive system tightens into a knot, with the limited waste products reprocessed into the bloodstream in the form of proteins. Bears, if not true hibernators, are certainly close. Bears sleep for months without eating, drinking, urinating or defecating. It has been said that while bears may not be true hibernators, they are "digestive hibernators."

Migration
When we think of migration, we generally think of birds. Some of the birds that spend summers in Glacier may fly hundreds or even thousands of miles to their wintering area. As birds migrate to warmer climates, they alter their food source and wait for spring or summer to return to their home territory. These amazing migratory treks vary in length; some may span the length of the globe. **Day length** is believed to be the major factor in telling birds it's time to move on. Winter in Glacier National Park is difficult. The food supply has diminished, the length of day and the time in which to locate food is reduced and the amount of energy needed to stay warm is increased.

While 92 birds are listed as common residents of Glacier in summer, only 28 birds are listed as common winter residents (see Glacier National Park Bird Field Check List 1990 in reference section). The Clark's Nutcracker is an example of a bird that migrates from its summer home up in the mountains to lower elevations during winter.


Clark's Nutcracker

Cold, wind, and blowing snow of the high country offer challenges greater than most animals can adequately cope with. For animals that remain active during winter, lower elevations offer easier access to food and more protection from the elements. Animals that move from areas of higher elevations to those that are lower with less snow and more food are considered "altitudinal migrators." Elk and mule deer are two other examples of animals that move from higher elevations in summer to lower elevations in winter.

While migration may seem like an easy option, it places a major strain on these animals. Huge energy reserves are required to make these seasonal journeys and migrators often face competition with native species once they arrive at their wintering site.

Resistance (or Toleration)
To many animals, winter means staying and enduring the challenges of the season and resisting its stresses. Because many organisms cannot simply flee from the cold Glacier winters, they have found numerous ways to survive the harsh climate. There are many fascinating adaptations in the animal world that help them resist winter's hardships.

Birds that resist winter stresses have numerous techniques for survival. When temperatures drop, birds will fluff out their feathers. Feathers are good **insulators**, and fluffed out feathers create a thick layer of stable air around the body. Many small birds **huddle** together at night to reduce heat loss. Others **roost** in tree cavities. Grouse hunker down in deep snow on cold nights, and a scaly projection on their toes helps them to walk on snow. Some birds, including grouse, will store large quantities of food in their **crops** late in the day to carry them through cold winter nights. Gray jays are known to store food on branches of trees or on the ground. Chickadees have an amazing ability to hang upside down on branches as they search for insects. This maneuver allows them to locate food when the upper surface of branches is snow covered. And woodpeckers continue to feed on insects deep within trees.

High in the alpine, the pika will remain active all winter in its den hidden among rock-slides. It will feed on "hay" made up of grass that was cut, dried and stored during summer. It has distinctive adaptations that allow it to survive the long and extreme winter conditions. Its small round ears lay flat along its head; an inconspicuous tail and short legs reduce surface exposure and heat loss; and fur insulates the soles of its feet and provide good traction. Pikas may look like rodents but they are related to rabbits.


Pika

Mountain goats are the largest mammals remaining active in the high country year-round. Their heavy wool **undercoats** and long hollow **guard hairs** provide protection from the cold and wind. Mountain goats can subsist on **lichens** and **mosses** if they cannot find adequate browse. In winter goats move to more south or southwest facing slopes where the winter sun melts snow more quickly and prevailing winds blow the snow away, exposing lichens and vegetation.

The Ptarmigan is the only bird that remains at or above treeline throughout the winter. This alpine cousin to the grouse changes its brown plumage to white as autumn light diminishes and winter snow begins to blanket the mountains. Feathered feet act as snowshoes which allow it to walk on snow. Sharp claws help it to scratch for food beneath the snow. Ptarmigan will feed on willow buds and the needles of subalpine fir. Warmth and protection from winds and sub-zero temperatures is attained by diving into the snow.

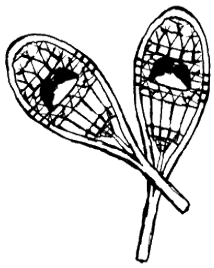
Prior to the actual onset of winter, animals that resist winter stresses have physiological responses that are cued in by the reduced daylight hours. Less daylight trigger a response that is registered in the "master control" gland (**hypothalamus**) in the brain. The hypothalamus then secretes **hormones** that activate other systems throughout the animal's body. Animals react in various ways. Moose, elk and deer begin to **rut**. The interval between the mating season and giving birth ensures the young will be born in the spring when food is abundant. Another reaction to shorter days is the urge to eat more thus building up layers of fat that will help animals make it through winter. Beavers and red squirrels **cache** extra food. Animals that remain active all winter will grow a thicker coat of fur. Deer, elk and moose have **winter coats** comprised of hollow hairs that trap air for better insulation. Other animals develop thick **undercoats**.

Snowshoe hares, weasels and ptarmigan in Glacier National Park turn white. The absence of the pigment melanin, means there are more air spaces within the hairs and thus it has greater insulation value. Snowshoe hares' white winter pelage has 27% better insulating qualities than the summer brown coat. **Photoperiod** triggers hormonal changes that are also influenced by cold and snow. These hormones cause changes in hair color. Weasels undergo a complete molt. Each hair is lost and a new white hair replaces it. Only the tip of the hair turns white on snowshoe hares, while the base remains gray. Timing is critical. A white snowshoe hare or weasel (ermine) makes an easy-to-spot target for a predator. Snowshoe hares as their name implies, have snowshoes: extra fur on the bottom of their large feet in winter helps distribute their weight so they can move on top of the snow with ease.

For animals that remain active in winter, snow is a mixed blessing. It can offer shelter and protection. Snow acts as insulation, holding in earth-warmed air and keeping out cold air. Snow creates a stable environment beneath it (**subnivean** layer) in which temperatures may range from about 20 degrees Fahrenheit to 30 degrees (F), while air temperatures can fluctuate from 30 degrees (F) below zero to 45 degrees (F) above zero. The subnivean world allows plants, insects and animals to escape from temperature extremes and wind. This is important for small animals like mice, voles and shrews. Since their body surface is large in proportion to their size, they lose heat rapidly and it takes considerable time (and energy) to replace it. Their small size does not allow them to carry a thick enough coat to withstand continual exposure to cold. The bark of trees and shrubs, seed heads from plants flattened by snow, and leaf litter/detritus provide much of the food for these small insects and animals. The tracks of mice, voles, and shrews indicate they do spend time on top of the snow (**supranivean** layer) in search of food but these forays can make them vulnerable to predators.

Humans in Winter
Although humans today do not have the capability of hibernating like bears or marmots, we are able to migrate or resist. Native Americans had many strategies for dealing with winter. They built shelters to protect themselves from the cold and wind. They had elaborate systems for obtaining and making warm clothing and for caching and storing food to last throughout the winter. They changed their behavior in winter to conserve energy. Some groups followed seasonal animal migrations in order to have access to more food or shelter from the wind during the winter months. Today, humans are still building shelters to protect ourselves from the cold. Modern clothing can still be found made of animal furs, feathers (down) and plants (wool and cotton), but also from materials like polypropylene or capilene. The infamous "snow birds" from the northern states (and Canada) move in droves in December to warmer climates and remain there until the end of winter.

Snowshoes
The use of snowshoes dates back over a long period of human history. Archaeologists estimate that the first "foot-extenders" used for easier snow travel originated in Asia about 6,000 years ago. Eskimos living in arctic regions did not require the use of snowshoes since most of their travel occurred on wind packed snow or on sea ice. For Native Americans living in forested temperate areas, snowshoes were a necessity for getting around in the winter. The Athabascan Indians of the American and Canadian west coat and the Algonquin Indians of the Ottawa and St. Lawrence River valley areas brought the snowshoes to perfection. Before horses were introduced to America by the Spaniards, the Plains Indians used snowshoes to hunt buffalo.



During the period of westward expansion, snowshoes were just as important as the axe and flintlock rifle in areas where snow was deep throughout winter. Trappers, hunter, explores and surveyors in these areas couldn't be without them. Perhaps the first snowshoes came about when someone watched how easily the snowshoe hare and lynx could travel across the surface of the snow. These animals have very large feet in relation to their body size. Bigger feet allow an animal to spread its weight over a larger surface area (less weight per square inch) which helps to keep it on top of the snow.

Snowshoes are just one of the technological innovations that humans have developed over time to help them to survive winter. By observing and learning how other organisms cope with winter stresses, humans have been able to continue to develop new techniques and strategies to make our lives easier in northern climates. It will be intriguing to see the discoveries and changes that happen in the next century as more information on the interrelationships between living things and their winter environment come to light.